



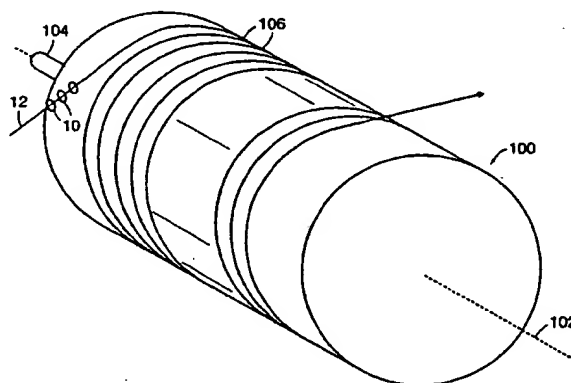
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: APPARATUS AND METHODS FOR DROPLET MICROCHEMISTRY

(57) Abstract

An apparatus and methods for performing microchemical manipulation and analysis of liquid samples. One or more droplets of liquid are loaded serially or in parallel onto a flexible member which may be a fiber or a tape, and are retained on the flexible member by virtue of surface adhesion. Microchemical operations may be performed on these droplets, the operations including mixing, dilution, concentration, heating, cooling, filtering, and analyzing, where the analyzing may include chemical, biochemical, optical, or other physical analyses.



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INTERNATIONAL SEARCH REPORT

Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B01L3/02 G01N35/02 B01L3/00 H05H3/04 G01D5/24
B01F15/00 B01J4/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B01L G01N G01D H05H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 566 677 A (COLE BENJAMIN T ET AL) 2 March 1971 see column 6, line 37 - line 45; figure 5 see column 4, line 52 - line 68 see column 3, line 1 - line 23; figure 1 ---	1,6, 8-10,16, 17
X	EP 0 641 599 A (BOEHRINGER MANNHEIM GMBH) 8 March 1995 see page 2, line 18 - line 32 see page 6, line 30 - line 43; figures --- -/--	1,2, 16-18, 20,21

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

20 April 1999

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INTERNATIONAL SEARCH REPORT

International Application No.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	see column 1, line 10 - line 14	1
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 643 628 A (SONDEREGGER MARCEL) 1 July 1997 see column 3, line 16 - line 18 see column 7, line 6 - line 27 see column 8, line 49 - column 9, line 17; figure 10 ----	1,25
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INTERNATIONAL SEARCH REPORT

International application No.

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Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international Application that do not comply with the prescribed requirements to such an extent that no meaningful international Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- | | |
|------------------|---------------|
| 1. CLAIMS: 1-21 | 2. CLAIMS: 22 |
| 3. CLAIMS: 23-24 | 4. CLAIMS: 25 |
| 5. CLAIMS: 26 | 6. CLAIMS: 27 |

FOR FURTHER INFORMATION PLEASE SEE FORM PCT/ISA/206 MAILED 06.01.99

1. ☒ As all required additional search fees were timely paid by the applicant, this international Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-21

apparatus for sampling and transporting at least a droplet adhering to a flexible member by virtue of the surface tension of the liquid

2. Claim : 22

method for filtering a liquid comprising adhering a droplet of the liquid preferentially containing a desired compound to a flexible member

3. Claims: 23-24

methods for translating a droplet adhering to a flexible member

4. Claim : 25

method for mixing a first and a second droplets adhering to a flexible member.

5. Claim : 26

method for measuring the position and dielectric properties of a droplet adhering to a flexible member.

6. Claim : 27

method for transporting a solid particle adhering to a flexible member.

The prior art has been identified as US3566677. It describes an apparatus for transporting droplets of liquid formed in a reservoir ('assembly 1') using a flexible member 3 made of interconnected loops 18 disposed for receiving the droplets from reservoir 1, the droplets adhering to loops 18 of the flexible member 3 by virtue of the surface tension of the liquid and being transported to an analyser. Claim 1 of the present application is not novel compared to that prior art. The use of a fiber (claims 2-3) or a ribbon (claim 4) as a flexible member for transporting droplets adhering by virtue of the surface tension of the liquid is also known. See for the use of fibers EP641599 (page 6 lines 34-43) or EP286410 (page 2, lines 11-16) and for the use of ribbons US5334837 (figure 27).

1. When compared to that prior art, the special technical features of group 1 in the sense of Rule 13.2 PCT is that the flexible member is formed into an enclosure for encapsulating at least one droplet of the liquid (claim 5), or that the flexible member is wrapped onto a drum having a plurality of wells within its surface, the droplets being positioned in each well. The problem to be solved is not to perturb the integrity of the droplets (see description page 11 lines 5-9 or page 12 lines 16-21)

2. When compared to the same prior art, the special technical feature of the second set of claims would be that the flexible member has compound selective wetting characteristics. The problem to be solved could be to control the chemical composition of the droplets (desc. page 8, line 9).

3. When compared to the same prior art, the special technical feature of the third set of claims would be the use of means for translating droplets. The problem to be solved is to move the droplets relative to the flexible member (desc. page 10, lines 13-14)

4. When compared to the same prior art, the special technical feature of the fourth set of claims would be the use of flexible members for mixing droplets. The problem to be solved is to combine droplets (desc. page 7, lines 11-24)

5. When compared to the same prior art, the special technical feature of the fifth set of claims would be the use of means for measuring the position of the droplets. The problem to be solved is to track the variation in position due to lengthening or shortening of the flexible member (page 8 lines 13-15)

6. When compared to the same prior art, the special technical feature of the sixth set of claims would be the use of a flexible member for transporting solid particles adhering by virtue of electrostatic force. The problem to be solved is the transport of solid particles (see desc. page 6 lines 27-30).

The above analysis shows that the special technical features of the different groups of claims are neither the same nor corresponding. The problems solved are different and do not form a single inventive concept in the sense of Rule 13.1 PCT.

This ISA considers therefore that this application do not fulfill the requirement of unity of invention and comprises six different claimed inventions.

INTERNATIONAL SEARCH REPORT

Information on patent family members

In Application No

PCT/US 98/17306

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